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(54) **Tower packing support for fluid-fluid contact**

(57) Counter current flows of at least on fluid occur in a chamber C having one or more internal supports comprising at least one hollow section 10 comprising a bight, first and second sidewalls 12 extending from the same side of said bight, a respective flangewall 16 projecting transversely outwardly from at least one said sidewall, and optionally a respective flankwall 18 projecting transversely outwardly from at least one said flangewall. Said at least one sidewall and flangewall have respective apertures 26, 30 each with an inlet and an outlet. At least one said outlet is adapted, eg. by provision of flanges 28, 32, to increase resistance therethrough to entrance of fluid from one flow direction in the chamber and/or at least one said inlet is similarly adapted to decrease resistance therethrough to entrance of fluid from said flow direction. Packing elements E can be carried on said support. The flanges 28, 32 further increase the strength and rigidity of the supports. The packing support is suitable for gas-liquid contact, eg. for heat transfer.

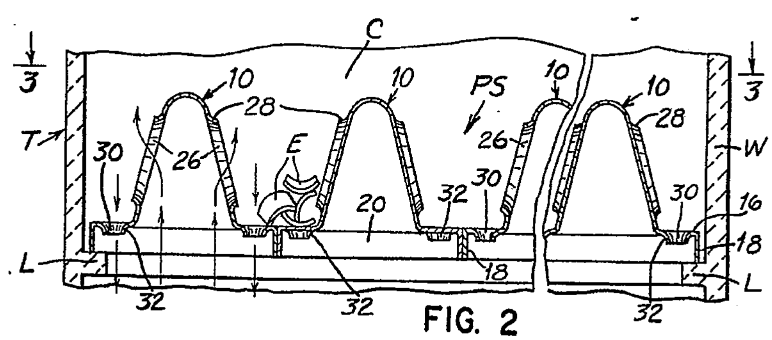

FIG. 2

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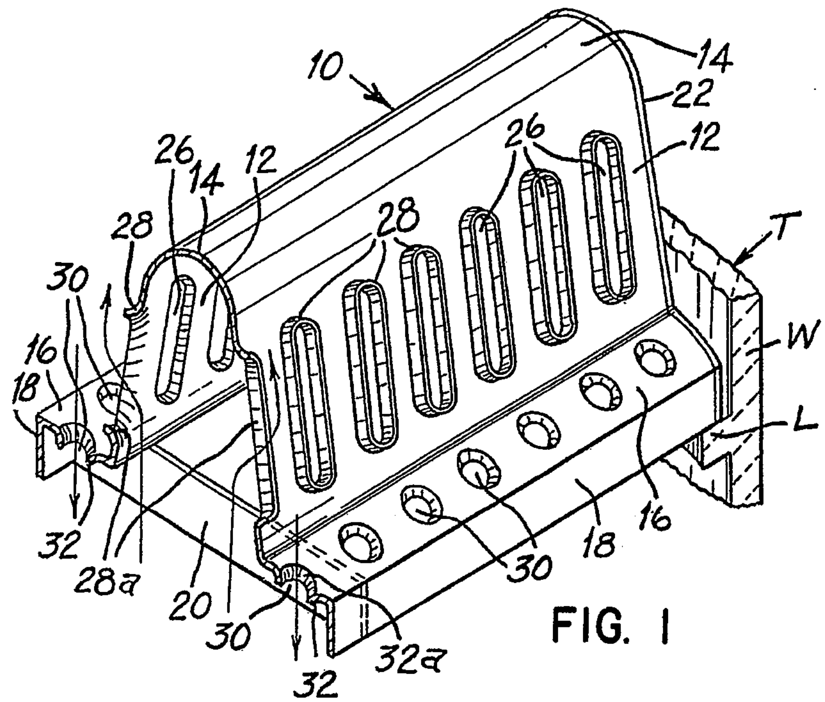


FIG. 1

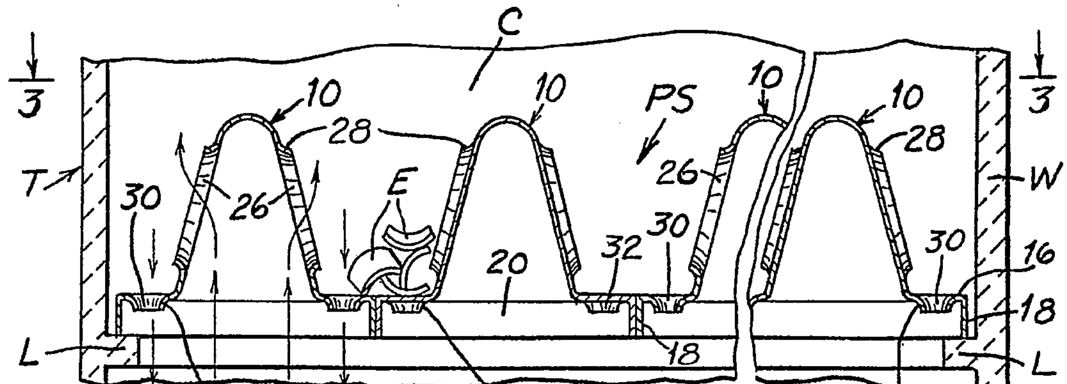
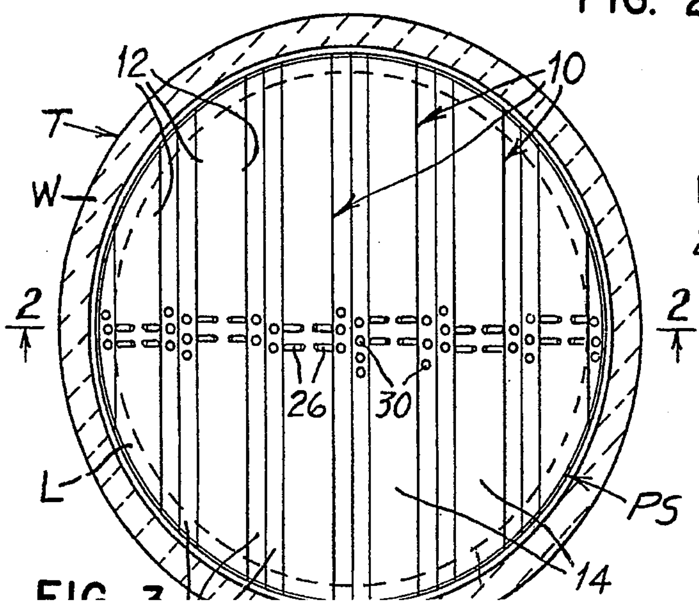


FIG. 2



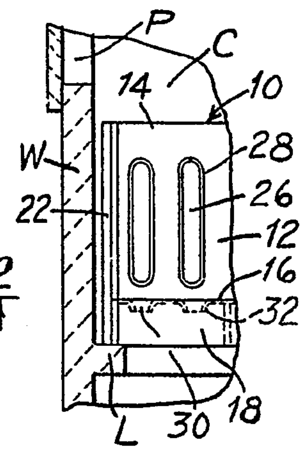


FIG. 4

FIG. 3

SPECIFICATION

Tower packing support

The invention relates to a perforated support plate for supporting and injecting fluids into a bed of packing elements in treatment towers or vessels and partciularly for a gas-liquid contact apparatus.

Various support systems and plates are known for supporting beds of packing elements in fluid-fluid, liquid-liquid and gas-liquid contact apparatus or towers, such apparatus being towers designed to bring two counter flowing mediums in contact to effect a specific treatment such as transfer of heat from one to the other.

Present packing support systems utilize sections with vertical or inclined and horizontal perforated portions in the general configuration of a beam to support packing. The essentially vertical portion will pass the upward flowing gas and is in the uppoer portion of the beam. The perforated horizontal or essentially horizontal portion will pass the liquid phase which flows downward and is in the lower section of the beam. By having the liquid and gas separate and pass different openings the pressure drop across the support system is reduced compared with support systems where the liquid and gas pass common openings in a counter current direction. The present systems have three general limitations.

First: The physical load from packing may be limited by the vertical or inclined perforated wall portion. If this portion is overloaded the side panels or walls will deflect inward and cause failure either structurally or from a flow handling characteristic or both.

Secondly: Around the perforated openings are relatively sharp edges which cause resistance to entrance and flow through the openings. This adds to the gas phase pressure loss of the support system.

Thirdly: The perforated vertical portion of the beam which must shed the down-coming liquid and allow the openings to remain free for the up-coming gas to pass through have essentially flat surfaces and the gas flow must keep the liquid from entering the perforations. Thus, some pressure must be lost by the gas to keep liquid from entering the perforations. This adds to the gas phase pressure loss of the support system.

The present invention greatly improves on all three of these limitations by smoothly flaring and raising the edge of the material around the perforated openings. This will add ribs and rigidity to the side panels to prevent inward deflections. Each entrance to the openings is smoothly rounded which reduces the resistance to flow, or in effect provides a higher orifice coefficient. Exits of the openings with relatively sharp edges are beyond the side panel and the down-coming liquid will be mostly restricted from entering from the exit of the opening and thereby decreases the resistance to the gas flow.

United States Patents Nos. 3,222,040 and 3,419,253 granted to John S. Eckert and assigned to Norton Company and Design Manual TA-70 entitled 'Packed Tower Internals' published by Norton Chemical Process Products Division, Akron, Ohio 44309, United States of America, copyright 1970, disclose packing support plates similar in many respects to and of the type with which the instant invention concerns itself.

However, this invention is an improvement over comparable prior art perforated support plates known to the applicant and differ therefrom in that the apertures providing the free or open space in the walls thereof have around them smoothly curved entrances and projecting rims or wall portions which improves directional flow characteristics of the counter flowing mediums, lowers the resistance to flow and thereby reduces the pressure drop across the support system. Also, the walls in each section of the support are strengthened by the projecting rims and have, depending on rim size, up to eight (8) times more resistance to bending or deflection than non-rimmed apertured walls of a comparable support section of identical size, shape and amount of free or open space. Hence, the support plate assembly has a much greater load supporting capacity in cases where the walls are limiting.

One preferred aspect of the present invention provides a tower packing perforated support plate comprising a plurality of adjacent elongated hollow section or beams each of which is adapted to be inserted through a manway in the wall of the tower. The sections extend beside one another across a chamber within the tower and are supported at opposite ends by a support, ledge or ring fixed to the wall around the chamber. The tower chamber can be of any configuration in cross-section and up to 12 feet (3.658 m) or more in diameter or width. Hence the support plate may include a relatively longer middle section which receives no side support and there may be as many as 12 or more adjoining or adjacent sections supported at their ends. As a result the middle section may have to carry a load of 5 tons (e.g. 4.5 metric tons) or more of the packing elements situated above the support plate.

Each section of the support plate has an upper elongated vertically extending portion with a chamber between spaced perforated sidewalls. Preferably the sidewalls are inclined and diverge downwardly from an arched top surface to lower adjoining perforated horizontal wall portions extending to short vertical wall portions abutting or slightly spaced from adjacent sections of the support plate. Extending around apertures or perforations in the inclined and horizontal wall portions are raised flanges or walls which project beyond adjacent surfaces of the wall portions to the exit ends of the apertures.

Resistance to entrance and flow of counter flowing mediums through the apertures is greatly reduced by smoothly curved entrance portions while the resistance to the entrance and flow of the counter flowing mediums from the opposite exit ends is greatly increased by the projecting walls or rims and sharper edge surfaces at the exit ends of the apertures. Hence, the pressure drop in the packing support system is greatly reduced.

In addition, the raised walls or flanges around the

apertures increases the resistance to bending, distortion and deflection of the wall portions and thereby strengthens and increases the load bearing capacity of the sections and hence the packing support plate.

Therefore, an object of the invention is to provide an improved perforated tower packing support of greater strength, lower resistance to entrance and flow of the counter flowing medium in one direction through separate groups of apertures and greater resistance to entrance and simultaneous flow of the counterflow mediums through the same apertures.

The present invention will now be described, by way of example, with reference to the accompanying drawings, wherein:—

Fig. 1 is a perspective view showing a portion and cross-sectional configuration of one of a plurality of adjoining elongated packing support sections in a packing support plate;

Fig. 2 is a vertical cross-section view through a portion of a tower taken on line 2-2 of Fig. 3 showing a support plate comprised of a plurality of sections shown in Fig. 1 extending horizontally across the chamber and supported by a ledge on the tower wall;

Fig. 3 is a cross-section through the tower taken on line 3-3 of Fig. 2 showing a top view of the support plate shown in Fig. 2; and

Fig. 4 is a vertical cross-sectional view through a portion of the tower walls showing an end portion of an elongated section supported by the ledge and part of the manway in the tower wall.

Referring to Figs. 1, 2 and 3 a fluid injection packing support PS of the instant invention comprises a plurality of adjoining elongated hollow packing support sections or members 10 of substantially identical cross-sectional configuration. Preferably the sections 10 are arranged side by side, either slightly spaced or in abutting relationship to each other, extend longitudinally across the chamber C and are supported at opposite ends by a ring or ledge L extending around the chamber C and fixed to the wall W of the tower T. In the tower wall W adjacent the ledge is the usual manway or passage P, Partly shown in Fig. 4, through which the sections 10 are passed and then assembled on the supporting ledge L.

Each elongated section of beam 10 is preferably a single unitized structure which can be fabricated or molded of various materials such as metals, plastics and ceramics. It also can be made in two or more parts fixed together as by welding, or with other suitable fasteners such as bolts, screws, and adhesives.

As shown by example in Fig. 3, the packing support PS is situated within a circular tower chamber and is, therefore, of circular configuration which may not always be the case. Hence, the circular packing support PS has a plurality of elongated sections 10 which vary in length from the longest nearest the center of the chamber to the shortest at opposite sides of the chamber.

The longest center section 10 supported only at its opposite ends has the greatest span and must therefore be rigidly constructed and strong enough to support a greater portion of the bed of packing elements E.

In cross-section, each of the elongated hollow sections, members or beams 10 has as shown in Figs. 1 and 2 an upper portion including a spaced pair of inclined or tapered perforated sidewalls 12 which diverge downwardly from a connecting upper top portion 14 preferably in the form of an arch. The spaced sidewalls 12 extend downwardly, typically at a predetermined relatively steep angle of 0° to 35° from the vertical to a pair of adjoining horizontal perforated wall portions 16 in the lower portion of the beam or member 10. The horizontal wall portions 16 extend to and are joined to spaced relatively short vertical imperforate sidewall or side portions 18 extending downwardly from the horizontal wall portions 16.

Extending between the spaced vertical sidwalls or flanges 18 are cross braces 20 situated at spaced intervals between the ends of each section 10. The braces maintain the spacing of the walls 18, rigidify and prevent the sections 10 from becoming distorted.

An end cap, wall or closure 22 is fixed to each opposite end of a section 10 to prevent packing elements from passing the opposite ends of the section. In most instances, where the chamber C and packing support plate PS are circular, the opposite ends of the sections 10 and end caps 22 are arcuately shaped to fit within and conform to the curvature of the chamber wall W. However, in some instances the end caps 22 can be eliminated when packing elements are sufficiently large and could not pass the opening between the ends of the sections and chamber wall.

Alternatively, the sections 10 may have straight flat bevelled end walls or caps situated at a suitable angel or parallel to the tower wall whereupon at least the entire lower surface edge of the end cap engages the ledge. The end wall or cap 22 could be placed at an angle which lies on a plane representing the chord of a corresponding arc of curvature of the adjacent chamber wall.

A plurality of elongated apertures 26 are provided in the diverging inclined walls 12 of each section 10 for the passage and injection of an upwardly flowing fluid, such as a gas, into the bed of the packing elements E.

Extending preferably around each of the apertures or slots 26 is a continuous primary flange, rim, rib or wall portion 28 projecting a predetedmined distance beyond the outer surface of the inclined walls 12. Each aperture 26 has around it a relatvely smooth inner peripheral surface 28*a* of the flange or rib 28 which extends from a smoothly curved entrance portion at the inner surface of the inclined wall 12 to a more sharply defined inclined exit end surface of the raised wall or flange 28.

As shown, the elongated apertures 26 and raised walls 28 there around extend longitudinally along the relatively flat inclined walls between the point of tangency with the arched top surface 14 and intersection with the horizontal wall portions 18.

Also, the elongated slots 26 in one inclined wall 12 may be either aligned with or staggered relative to

the slots 26 in the opposite inclined wall 12 or the inclined wall of an adjacent member or section 10.

Alternatively, the inclined walls 12 may have a plurality of rimmed apertures of smaller or larger size and of any known geometric configuration.

It can be seen that a fluid such as a gas flowing upwardly and directed into the internal chamber between the inclined walls 12 can easily enter the smoothly curved entrances of the apertures 26 and pass therethrough into the bed of packing elements E. On the other hand a fluid such as a liquid flowing downwardly finds it more difficult to enter the sharper exit ends of the apertures because in addition to the resistance provided by the up-flowing gas, the raised rims or flanges 28 project into and shed the down-coming liquid away from the exit ends. Further, the exits of the apertures 26 are usually narrower than the smoothly curved entrances and the exit ends of the rims 28 have more sharply defined end surfaces and edges to resist entrance of the down-coming fluid.

Similarly, the horizontal wall portions 16 of the sections 10 have preferably a plurality of longitudinally spaced rimmed openings or apertures 30. Extending preferably around each opening 30 is a continuous secondary rim, flange or wall portion 32 which projects downwardly a predetermined short distance from the underside or lower surface of the horizontal wall portion 16. The rimmed apertures 30 have around each of them a relatively smooth inner peripheral surface 32*a* of the rim 32 which extends from a smoothly curved entrance at the top surface of the substantially horizontal wall 16 to a more sharply defined exit end surface projecting below the adjacent surface or underside of the wall 16.

Although the openings 30 shown, by example, are of circular configurations they may be elongated or of any other geometric configuration. Also, they may be of larger or smaller size, vary in number, be either staggered or aligned relative to each other or to the elongated apertures or slots 26.

The smoothly curved entrance portions of the apertures 30 lowers the resistance to entrance and flow of the down-coming fluid through the packing support plate PS from a bed of packing elements E supported thereon. In contrast, the sharply defined exit end surfaces or edges and the outer peripheral surfaces of the projected rims or walls 32 increases the resistance to the entrance and passage of the counter up-flowing fluid from the exit ends over and above the resistance provided by the flow of the down-coming fluid through the openings 30.

Depending on the specific requirements including the type of packing to be supported and use, the size and shape of the sections 10 and the support plate PS; the amount of free space provided by the apertures 26 and 30; the degree of curvature at the entrances of the apertures as well as the amount the walls or flanges 28 and 32 projects beyond the walls 12 and 16 and the inclination of the walls 12 can be varied to suit and obtain the desired load supporting strength and results from the apparatus.

Thus, in operation a preferred packing support plate of the invention is more effective in separting and directing the counter flowing fluids to flow through separate openings, lowers the resistance to entrance and flow of the fluids through the openings in one direction and increases the resistance to the entrance and simultaneous flow of the counter flowing fluids through the same openings in the support plate. As a result the pressure drop across the packing support system is greatly reduced.

A multibeam packing support plate of the invention can be made of various materials to fit within tower chambers of various sizes and configurations by fabricating a number of substantially identical sections of proper length with flanged apertures therein and assembling them side by side on the supporting means provided in the tower chamber. With the exception of the flanges about the apertures, the sections of the invention are generally comparable in height, width, length, material, shape and amount of free or open space to similar sections used in fabricating comparable prior art support plates such as disclosed in the above mentioned prior art references.

Plastic and ceramic sections are molded to form in the well known manner while metal sections are fabricated in the usual manner from sheet metal of the desired type. When the sections are molded, the integral flanges around the apertures can be made to project any suitable desired amount regardless of the size and spacing of the apertures.

However, when fabricated from an integral sheet of metal, the desired width or diameter and spacing of the openings or apertures usually determines the maximum amount of metal available about the axis or on opposite sides of the center of the openings which can be flared out and the maximum height of the flanges. Alternatively, the metal flanges or rims of any suitable height could be made separately and fastened, as by welding around the apertures of any size in a separately formed section.

Preferably, the metal sections are fabricated from an integral sheet of metal which is pierced or slitted at the center or a predetermined distance along the center of the desired aperture in order to utilize all of the metal available, obtain flanges of maximum height and walls of maximum rigidity. However, the flange height can be reduced to a height less than the maximum obtainable from an aperture of specific size by removing or cutting away a portion thereof in any suitable manner. A portion of the metal can be removed prior to flaring by punching therein a smaller aperture of substantially the same configuration and proportionally smaller in size than the final size of the desired aperture.

Typically the flanges about the apertures 26 and 30 project about .340 inches (8.64 mm) beyond the adjacent wall surface and the radius of curvature of the smoothly curved inner peripheral surfaces 28*a* and 32*a* at the entrance to each aperture 26 and 30 is approximately .3125 inches (7.94 mm).

Fabrication of a typical metal section or beam 10 is preferably done by dieing or stamping out and bending with conventional metal working tools and apparatus a single piece of sheet metal of predetermined width, length and wall thickness, typically about .0625 inches (1.587 mm) thick.

The apertures 26 and 30 and flanges 28 and 32

around them may be formed by punching, drawing and flaring the material to the desired curvature or radius, height and size about the openings.

The punched, drawn and flared sheet of metal is then bent at opposite sides to form the horizontal and vertical walls 16 and 18 and at the center to form the arch 14 and inclined wall portions 12 to the desired configuration and dimensions. The braces 20 of strip metal cut to length are then welded in place between the vertical walls 18 at predetermined intervals, preferably in between the apertures 26 and 30.

End caps 22 and the ends of the section are arcuately formed and welded together to fit within and closely conform to the curvature of the chamber wall and engage the supporting ledge L.

With respect to defining the flanges the word "around" used herein is to be interpreted to mean flanges or rims extending partially as well as completely around the apertures and openings in the sections.

Although a specific embodiment of the invention has been disclosed herein above, other embodiments and modifications thereof are possible that fall within the teachings of the invention. For example a multibeam support with flanged apertures may be, depending on its size, a single unitary multibeam structure or a composite structure comprised of a plurality of integral multibeam sections, each integral multibeam section having at least two elongated beams therein.

Alternatively, flanges or rims may be provided either around only the apertures 26 in the inclined walls and not about the openings 30 or around only the apertures 30 and not about the apertures 26. Also, the flanges may extend around some but not all of the apertures 26 and openings 30 and either completely or partially around the apertures 26 and openings 30. Also, the entrances to the apertures and openings may be beveled at an angle instead of curved or rounded to enlarge the size and area thereof and extend continuously at an angle or radius of curvature from the enlarged entrances to either the exits, or to narrower or narrowest parts of the passages located down-stream from their entrances.

A comparison of the flow capacity, pressure drop and strength has been made between a multibeam support plate of the invention and a prior art model 804-R2 metal multibeam support plate of comparable size, material, and percent of open area disclosed in the above mentioned Bulletin TA 70, hereinafter referred to as a model 804.

The model 804 support plate is made up of six (6) parallel beams about $11^{3}/_{4}$ inches (29.8 cm) from center to center. The beams are $11^{3}/_{8}$ inches (28.9 cm) wide, fabricated from .0625 inch (1.58 mm) thicksheet metal and spaced .375 inches (9.52 mm) apart. Each of the twelve (12) inclined walls have five (5) rows of $^{5}/_{8} \times 1^{5}/_{8}$ inches (1.58×4.12 cm) elongated or abround slots in a staggered pattern. Center to center the slots are spaced $1^{3}/_{4}$ inches (4.44 cm) along the incline and $^{7}/_{8}$ inches (2.222 cm) horizontally which provides an incline perforated section of about $8^{5}/_{8}$ inches (21.9 cm) wide along the incline by the length of the beam. There is a single row of $^{5}/_{8} \times 1^{5}/_{8}$ inches (1.58×4.12 cm) abround or elongated slots in each horizontal wall spaced $^{7}/_{8}$ inches (2.222 cm) center to center. The total open area provided in the inclined walls is about 88.7% of the cross-sectional area of the tower chamber.

For comparison the support plate of the invention has the same percent of open area in the inclined walls and horizontal walls as the 804. However, it differs in that it has a single row of abround or elongated slots about $^{5}/_{8} \times 10.473$ inches (1.587×26.6 cm) long spaced $1^{1}/_{4}$ inches (3.17 cm) center to center in the inclined perforated section of each inclined wall. The abround slots or apertures in both the incline and horizontal walls have flanges around them. Each flange has an inner smoothly curved surface with a maximum radius of about .3125 inches (7.93 mm) which extends from the entrance to a straight portion about .091 inch (2.3 mm) long adjoining the exit of the slot or aperture. Thus, the flange and aperture or slot have a total depth of about .4035 inches (10.2 mm) in between the entrance and exit and, less the wall thickness, project about .342 inches (8.7 mm) beyond the adjacent surface of the wall.

In comparing the reduced resistance to flow through rounded flanged slots in a support plate of the invention with the straight slots in the model 804, one merely has to refer to a suitable engineering handbook such as one entitled "Handbook of Hydraulic Resistance Coefficients of Local Resistance and of Friction" by I. E. IDEL'CHIK, 1960, distributed by (NTIS) National Technical Information Service, U.S. Department of Commerce.

The handbook takes the Reynolds number and resistance factors into account and provides relationships for walls having sharp and round or curved edged orifices. When compared they will show that rounded edge orifices or apertures provide an overall lower resistance to flow. These relationships will apply to both the gas and liquid flow through the apertures.

From the information disclosed on pages 81-83, 112, 122, 124 and 143-144, it can be determined that the model 804 plate has a lower Reynolds number of about 600 compared to 750 for a support plate of the invention when based on a mean stream velocity of 10 m/sec and a maximum kinematic viscosity of 400 centistoke. Also, where the Reynolds number is less than 10^{5} and the coefficient of friction is less than 0.1 (which is the case) it can be determined that a support plate of the invention with rounded edges at the entrance to the flange apertures has a lower coefficient of resistance to flow of about 1.37 and one-half that of 2.8 for the model 804 with sharp edge orifices. Thus, it can be concluded that a support plate of the invention offers less resistance to flow than the 804.

In comparison to the 804 a preferred metal support plate of the invention has up to 30% less pressure drop at the same gas flow rate and percent of open area for gas flow. This means that at the same pressure drop and same percent of open area for gas, it will handle up to 20% more gas than the 804 and could handle the same gas flow rate as the 804 with as much as 9% reduction in size of the apertures and

open area for gas.

Regarding strength, a support plate is not only limited by the total load it can support which is its beam strength but also by the unit load which its sidewall can support without collapsing. A metal support plate of the invention made of the same material and thickness with the same amount of open area as the 804 has sidewalls of greater rigidity which can support up to eleven (11) times or 1100% greater unit load than the 804 in cases that are limited by sidewall strength.

Thus, a support plate of the invention with the same thickness sidewall and metal can support a bed of packing elements about 1100% greater in depth than the 804 in cases that are limited by sidewall strength.

Likewise, a comparison of the sidewall strength between the model 804 and a support plate of the invention with flanged apertures can be determined by referring to any suitable engineering handbook such as one entitled "Mechanics of Materials" by F. E. Miller and H. A. Doeringsfield, 1960, published by International Textbook Company. Since both plates are made of the same material, the same thickness and for the same application, the allowable stress would be the same in both cases. It can be shown that Model 804 can only support about 9% of the load that a support plate of the invention with flanged apertures can support.

Preferably, the support plate of the invention has apertures and openings with enlarged entrances of sufficient size, shape and area whereby in use the support plate has a coefficient of resistance to flow of from 1.37 to less than 2.8, at least 5% less resistance to entrance and flow of the counter flowing gas and liquid or fluids through the apertures and openings and at least 5% less pressure drop at the same gas flow rate than the comparable support plate 804 mentioned above having an equal amount of open area in the self supporting sidewall and horizontal wall portions thereof, without flanges about the apertures and openings and more sharply defined non-enlarged entrances to the apertures and openings.

Also the Applicants' support plate can have a Reynolds number greater than 600 and on up to 750 at a mean fluid stream velocity of 10 m/sec and a maximum kinematic viscosity of 400 centistoke, and at the same pressure drop will handle at least 5% more gas than the comparable 804 plate with the same amount of open area.

Further, the lower resistance to flow through the apertures and openings is obtained preferably by smoothly curving the inner peripheral surfaces of the flanges so they have a radius of from 25% to 50% the width of the adjoining aperture or opening at the entrances thereto.

Additionally, the flanges are of sufficient length, generally equal to the length or distance around the apertures and openings and project from the sidewall and horizontal wall portions a sufficient depth of from 20 to 60% the normal or minimum width or diameter of the adjoining flanged aperture or opening. As a result the sidewall portions have from 2 to 11 times more strength, rigidity and load carrying capacity than self supporting sidewall portions of the comparable 804 plate with an equal amount of open area and without flanges about the apertures.

In that alternative nomenclature is used at various places in the above description, this nomenclature has been given so as to exemplify some equivalent embodiments and to indicate generic senses.

CLAIMS

1. A support section for use in a chamber in which counter current flows of at least one fliud will be provided, said support section comprising a bight, first and second sidewalls separted by and extending in directions from the same side of said bight, and a respective flangewall projecting transversely outwardly from at least one said sidewall, wherein:

at least one said sidewall comprises at least one respective aperture having an inlet and an outlet communicating with that inlet;

said flangewall comprises at least one respective aperture having an inlet and an outlet communicating with that inlet; and

at least one said outlet of a said sidewall and/or at least one said inlet of a said flangewall is adapted at least partly to increase resistance to entrance therethrough of fluid from a flow direction in said chamber.

2. A support section as claimed in claim 1, wherein said bight is arched.

3. A support section as claimed in claim 1 or 2, wherein at least one said sidewall has an angle of divergence with respect to said bight.

4. A support section as claimed in claim 3, wherein said angle or divergence is at most substantially 35° with respect to a normal through the center of said bight, said normal being in a plane comprising said bight and said sidewalls.

5. A support section as claimed in claim 3 or 4, wherein each said sidewall has the same or a different said angle of divergence.

6. A support section as claimed in any one of claims 1 to 5, wherein at least one said sidewall has a plurality of said respective apertures thereof.

7. A support section as claimed in claim 6, wherein each said said sidewall has a plurality of said respective apertures thereof.

8. A support section as claimed in any one of claims 1 to 7, wherein at least one said respective aperture of a said sidewall is aligned with at least one said respective aperture of the other said sidewall, and/or aligned or staggered with at least one said respective aperture of at least one said flangewall.

9. A support section as claimed in any one of claims 1 to 8, wherein at least one said respective aperture of a said sidewall is staggered with respect to at least one said respective aperture of the other said sidewall, and/or aligned or staggered with at least one said respective aperture of at least one said flangewall.

10. A support section as claimed in any one of claims 1 to 9, wherein said inlet of a said respective aperture of a said sidewall is adapted at least partly to decrease resistance to entrance therethrough of

fluid from said chamber.

11. A support section as claimed in claim 10, wherein said inlet of a said respective aperture of a said sidewall is at least partly smooth so as to decrease resistance to entrance therethrough of fluid.

12. A support section as claimed in claim 10 or 11, wherein said inlet of a said respective aperture of a said sidewall has an enlarged orifice.

13. A support section as claimed in claim 12, wherein said enlarged orifice is a bevelled orifice.

14. A support section as claimed in any one of claims 1 to 12, wherein said inlet or a said respective aperture of a said sidewall is at least partly wider than said outlet of that aperture.

15. A support section as claimed in any one of claims 1 to 14, wherein said inlet of a respective aperture of a said sidewall communicates via a linear passage with said outlet of that aperture.

16. A support section as claimed in any one of claims 1 to 15, wherein said inlet of a said respective aperture of a said sidewall communicates via a curved passage with said outlet of that aperture.

17. A support section as claimed in any one of claims 1 to 16, wherein said outlet of a said respective aperture of a said sidewall has a rim projecting outwardly from at least part of that sidewall.

18. A support section as claimed in any one of claims 1 to 17, wherein said outlet of a said respective aperture of a said sidewall is sharply defined.

19. A support section as claimed in any one of claims 1 to 18, wherein at least one side respective aperture of a said sidewall has at least one longitudinal dimension directed towards said bight.

20. A support section as claimed in any one of claims 1 to 19, wherein at least one side flangewall has a plurality of said respective apertures thereof.

21. A support section as claimed in any one of claims 1 to 20, wherein each each of said sidewalls has a respective said flangewall.

22. A support section as claimed in claim 21, wherein each said flangewall has a plurality of said respective apertures thereof.

23. A support section as claimed in claim 21 or 22, wherein at least one said respective aperture of a said flangewall is aligned with at least one said respective aperture of the other said flangewall.

24. A support section as claimed in any one of claims 21 to 23, wherein at least one said respective aperture of a said flangewall is staggered with respect to at least one said respective aperture of the other said flangewall.

25. A support section as claimed in any one of claims 1 to 24, wherein said inlet of a respective aperture of a said flangewall is adapted at least partly to decrease resistance to entrance therethrough of fluid.

26. A support section as claimed in claim 25, wherein said inlet of a said respective aperture of a said flangewall is at least partly smooth so as to decrease resistance to entrance therethrough of fluid.

27. A support section as clamed in claim 25 or 26, wherein said inlet of a said respective aperture of a said flangewall has an enlarged orifice.

28. A support section as claimed in claim 27, wherein said enlarged orifice of a said flangewall is a bevelled orifice.

29. A support section as claimed in any one of claims 1 to 28, wherein said inlet of a said respective aperture of a said flangewall is at least partly wider than said outlet of that aperture.

30. A support section as claimed in any one of claims 1 to 29, wherein said inlet of a said respective aperture of a said flangewall communicates via a linear passage with said outlet of that aperture.

31. A support section as claimed in any one of claims 1 to 30, wherein said inlet of a said respective aperture of a said flangewall communicates via a curved passage with said outlet of that aperture.

32. A support section as claimed in any one of claims 1 to 31, wherein said outlet of a said respective aperture of a said flangewall has a rim projecting outwardly from at least part of said flangewall.

33. A support section as claimed in any one of claims 1 to 32, wherein said outlet of a said respective aperture of a said flangewall is sharply defined.

34. A support section as claimed in any one of claims 1 to 33, comprising a respective flangewall projecting transversely from at least one said flangewall.

35. A support section as claimed in any one of claims 1 to 34, comprising means for bracing apart said sidewalls.

36. A support section as claimed in any one of claims 1 to 35, comprising at least one prevention means for preventing passage of at least one said packing element through space between said bight and said sidewalls.

37. A support section as claimed in claim 36, wherein at least one said prevention means is a boundary to said space between said bight and said sidewalls.

38. A support section as claimed in claim 36 or 37, wherein at least one said prevention means at least partly conforms with or is inclined or parallel to the inner periphery of said chamber.

39. A support section as claimed in any one of claims 36 to 38, wherein at least one said prevention means comprises cover means.

40. A support section as claimed in any one of claims 1 to 39, wherein at least a portion of said support section is a unitary structure.

41. A support section as claimed in any one of claims 1 to 40, wherein at least a portion of said support section is a composite structure.

42. A support section as claimed in any one of claims 1 to 41, wherein at least a portion of said support section comprises metal material.

43. A support section as claimed in any one of claims 1 to 42, wherein at least a portion of said support section comprises plastics material.

44. A support section as claimed in any one of claims 1 to 43, wherein at least a portion of said support section comprises ceramic material.

45. A support section as claimed in claim 1, substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

46. A support for use in a chamber in which counter current flows of at least one fluid will be

provided, said support comprising at least one support section as claimed in any one of claims 1 to 45.

47. A support as claimed in claim 46, wherein there is a plurality of said support sections.

48. A support as claimed in claim 47, wherein there are said support sections which abut each other.

49. A support as claimed in claim 47 or 48, wherein there are said support sections which are apart from each other.

50. A support as claimed in any one of claims 47 to 49, wherein said bights face the same direction.

51. A support as claimed in any one of claims 47 to 50, wherein at least one said aperture comprised by a said support section is aligned with at least one said aperture comprised by at least one other said support section.

52. A support as claimed in any one of claims 47 to 51, wherein at least one said aperture comprised by a said support section is staggered with respect to at least one said aperture comprised by at least one other said support section.

53. A support as claimed in any one of claims 46 to 52, wherein at least a portion of said support is a unitary structure.

54. A support as claimed in any one of claims 46 to 53, wherein at least a portion of said support is a composite structure.

55. A support as claimed in claim 46, substantially as hereinbefore described with reference to the accompanying drawings.

56. A chamber in which counter current flows of at least one fluid will be provided, comprising mounted therein at least one said support section as claimed in any one of claims 1 to 45, and/or at least one said support as claimed in any one of claims 46 to 55.

57. A chamber as claimed in claim 56, wherein said chamber is adapted for counter current flow of gas and liquid.

58. A chamber as claimed in claim 56 or 57, wherein a plurality of said bights face upwards in said chamber.

59. A chamber as claimed in any one of claims 56 to 58, wherein a tower comprises said chamber.

60. A chamber as claimed in claim 56, substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

61. A bed of packing elements in a chamber as claimed in any one of claims 56 to 60, wherein said bed is on at least one said support section or on a said support.

62. A bed as claimed in claim 61, wherein at least one said packing element is a curved packing element.

63. A bed as claimed in claim 61, substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

64. A method of carrying out counter current flows of at least one fluid, comprising carrying out said counter current flows through a bed of packing elements as claimed in any one of claims 61 to 63.

65. A method as claimed in claim 64, substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

66. A support plate for supporting a bed of packing elements within a chamber of a fluid treatment tower adapted to support the support plate comprising a plurality of sections each adapted to span a portion of the chamber and be supported at opposite ends having a top wall portion above an internal chamber, spaced sidewall portions including apertures through which fluid passes extending downwardly to horizontal wall portions, including openings through which a counter flowing fluid can pass, extending to opposite sides of the section wherein the improvement comprises:

flanges, including inner peripheral surfaces extending from a wall portion and at least partially around between entrances and exits of at least some apertures or openings in a wall portion of at least one section of the support plate, whereby the flanges increase the strength, rigidity and the load carrying capacity of the wall portion.

67. A support plate according to claim 66, wherein each section further comprises:

primary flanges, including inner peripheral surfaces extending from the spaced sidewall portions and at least partially around between entrances and exits of at least some of the apertures in the spaced sidewall portions, whereby the primary flange increases the strength, rigidity and the load carrying capacity of the spaced sidewall portions.

68. A support plate according to claim 67, wherein each section further comprises:

secondary flanges, including inner peripheral surfaces, extending from the horizontal wall portions and at least partially around between entrances and exits of at least some of the openings in the horizontal wall portions, whereby the secondary flanges increase the strength, rigidity and the load carrying capacity of the horizontal wall portions.

69. A support plate according to claim 68, wherein the apertures and openings with flanges about them in the spaced sidewall and horizontal wall portions have enlarged entrances larger in size and area than their smallest portions located downstream from the entrances, whereby the enlarged entrances reduce the resistance to entrance and flow of the fluid through the apertures and openings.

70. A support plate according to claim 69, wherein the apertures and openings with flanges about them have exits that are more clearly defined than the entrances, whereby the more sharply defined exits increase resistance to entrance of fluid from the exits and simultaneous flow of counter flowing fluids through the same apertures and openings.

71. A support plate according to claim 70, wherein the inner peripheral surfaces of the primary and secondary flanges extending around apertures and openings in the spaced sidewall and horizontal wall portions are curved from and adjacent inner surfaces of the spaced sidewall portions and upper surfaces of the horizontal wall portions at the entrances to the apertures and openings.

72. A support plate according to claim 71, wherein the primary and secondary flanges have relatively sharp edges at the exits of the apertures and openings.

73. A support plate according to claim 72, wherein the exits of apertures and openings with flanges about them in the spaced sidewall and horizontal wall portions are smaller in size and area than the enlarged entrances.

74. A support plate according to claim 73, wherein all of the apertures and openings in the spaced sidewall and horizontal wall portions have flanges extending continuously around them.

75. A support plate according to claim 74, wherein the apertures in the spaced sidewall portions are elongated and extend lengthwise between the top wall and the horizontal wall portions.

76. A support plate according to claim 75, wherein the spaced sidewall portions are inclined and diverge downwardly from the top wall to the horizontal wall portions.

77. A support plate according to claim 76, wherein the top wall is arched.

78. A support plate according to claim 77, wherein the elongated apertures in one inclined sidewall portion are staggered relative to the apertures in an opposite inclined wall portion.

79. A support plate according to claim 78, wherein the openings in the horizontal wall portions are staggered relative to the apertures in the adjacent inclined sidewall portion.

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